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### The value of tailored communication in promoting medication intake behavior

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# Chapter 1

## Introduction

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## Introduction

“Just as cats chase mice but don’t necessarily eat them, humans chase medicines but don’t necessarily take them”(Misselbrook, 2001, p. 173).

Hippocrates described the concern with patients not taking their prescribed medication over 2000 years ago; however, this issue continues to generate intense debate today (Brown & Brussel, 2011). Many patients, especially those with chronic illnesses, experience difficulty with taking their medication as prescribed. Therefore, it is not surprising that the average successful medication intake rates for long-term treatment are low. One of the proposed strategies for improving medication intake behavior is tailoring. Sabaté (2003) proposed that interventions should be tailored to the needs of a patient to achieve maximum impact. To accomplish this tailoring, health care systems and providers need to develop means for accurately assessing the determinants of medication intake behavior. Although tailoring is regarded as the most promising strategy (Sabaté, 2003; Van Dulmen, 2011), little is known about appropriate methods, how messages should be tailored, and how content should be adapted to the individual receiver. In this chapter, medication intake behavior will be discussed first; the importance of tailored communication for encouraging successful medication intake behavior will be discussed second; and types of media that can be used for promoting successful medication intake behavior will be discussed last.

### Medication intake behavior

Appropriate medication intake behavior can aid patients by reducing the risk of relapse (Ediger et al., 2007). For example, Kane, Huo, Aiekns and Hanauer (2003) found that patients with inflammatory bowel disease (IBD) who failed to adhere to a maintenance medication schedule had a 61% probability of relapse compared with patients who took their medication as prescribed. However, despite the strong association between successful medication intake behavior and health outcome, poor medication intake behavior remains a significant problem. Reports of the World Health Organization (WHO) and the National Institute for Health and Clinical Excellence (NICE) reveal that 30–50% of patients with chronic long-term illnesses do not take their medication as prescribed (Nunes et al., 2009; Sabaté, 2003). What are the reasons for this behavior?

Medication intake behavior is complex. Several terms are used to describe the concept of medication intake behavior. Compliance, adherence, concordance, persistence, and medication intake behavior have all been used to describe whether a patient is taking or not taking his or her medication as prescribed. However, the terms differ slightly in connotation and/or content. *Compliance* can be interpreted as a patient’s competence for following the providers’ recommendations. This competence suggests a potentially

distressed relationship with the provider. Taking medication as prescribed depends on the quality of the instructions given and the role of the patient in following the provider's orders (Horne, 2006; Vermeire, Hearnshaw, Van Royen, & Denekens, 2001; Vrijens et al., 2012). *Adherence* is defined as the extent to which patient behavior corresponds to the *agreed* recommendations of the provider. The definition of adherence implies that patients have the freedom to decide whether they agree with the treatment regimen (Haynes, Ackloo, Sahota, McDonald, & Yao, 2008; Kane & Robinson, 2010; Vermeire et al., 2001; Vrijens et al., 2012). *Concordance* focuses on the cooperation between the patient and the provider and is predominantly used in the United Kingdom (Horne, 2006). In this definition, the terms communication, patient support for taking medication, shared decision-making, patient beliefs, and preferences have been emphasized and considered (Horne, 2006; Vrijens et al., 2012). *Persistence* is used to describe the length of time between the first and the last dose, which immediately precedes discontinuation of the medication (Urquhart & Vrijens, 2005; Vrijens et al., 2012). Last, the act of taking or not taking the medication as prescribed is a behavior (DiMatteo, Haskard-Zolnierrek, & Martin, 2012). *Medication intake behavior* is defined as the extent to which patients succeed or fail to take medications as prescribed. Compared with the previously defined terms, this definition is based on a simple but wide-ranging approach in which both the provider and the patient play a role. For this reason, the term medication intake behavior will be used throughout this dissertation.

Similar to the Information-Motivation-Strategy model of Dimatteo and colleagues (2012), medication intake behavior can be considered a result of cognitive, affective, and behavioral factors. The cognitive component highlights the importance of patient knowledge and its achievement through effective provider-patient communication. The affective component includes a patient's (lack of) motivation or a negative or positive attitude towards medication. The behavioral component includes a patient's (lack of) workable strategy for following treatment recommendations (Dimatteo et al., 2012).

### **Barriers to successful medication intake behavior**

To improve medication intake behavior, specific reasons for poor medication intake behavior need to be addressed. Patients may report unintentional (e.g., when a patient is not able to recall medication instructions due to memory problems) and intentional (e.g., when a patient decides not to take medication due to a fear of side effects) poor medication intake behavior (Sabaté, 2003). Barriers to successful medication intake behavior can be practical (cognitive and/or behavioral) and/or perceptual (affective) and are considered important determinants of taking the medication as prescribed. Existing evidence suggests that patients' perceptual barriers are more predictive of intentional poor medication intake behavior than of unintentional poor medication intake behavior, and practical barriers are more predictive of unintentional poor medication intake

behavior than of intentional poor medication intake behavior (Horne, Parham, Driscoll, & Robinson, 2009; Wroe, 2002; Wroe & Thomas, 2003).

### ***Practical barriers***

Practical barriers (i.e., memory barriers or daily routine barriers) refer to cognitive or behavioral difficulties relating to medication intake behavior. *Memory barriers* are associated with a patient's cognitive information-processing problems, such as difficulty comprehending treatment information and recalling medication instructions (Kane & Robinson, 2010). According to Ley's cognitive model, medication intake behavior is largely determined by a patient's capability to memorize and understand medical information (Ley, 1979). The importance of remembering and understanding medical information for promoting successful medication intake behavior is emphasized in various research (Flocke & Stange, 2004; Kessels, 2003; Ley, 1976; Ley, 1979). If patients are unable to memorize specific information, even the most effective treatment recommendations may be useless (Bartlett et al., 1984; Flocke & Stange, 2004; Ley, 1979). As a consequence of poor patient recall, patients are more likely to misinterpret instructions, which may lead to misuse or unintentional poor medication intake behavior (Cameron et al., 2010; Kane & Robinson, 2010). Although the relationship between recall of medical information and medication intake behavior is often described in research (Kessels, 2003; Ley, 1979), only a few studies exist that have explicitly examined this relationship.

*Daily routine barriers* refer to the perceived inconvenience of taking medication according to the treatment regimen, which may be attributed to the difficulty of integrating the medication regimen into daily life (Kane & Robinson, 2010). This component may be influenced by a patient's belief in taking the medication as prescribed under certain conditions, such as interruptions of their normal daily routine (Cameron et al., 2010; Kane & Robinson, 2010). Recent studies have indicated that interruptions in a patient's daily routine are an important predictor for poor medication intake behavior (Vervloet, 2013). In this case, it is important that patients believe that they are capable of overcoming these obstacles.

### ***Perceptual barriers***

Perceptual barriers are based on an internal negotiation between the perceived necessity of the treatment and any related concerns and are considered proximal determinants of medication intake behavior (Clifford, Barber, & Horne, 2008; Horne & Weinman, 1999; Horne, Weinman, & Hankins, 1999; Horne et al., 2009; Menckeberg et al., 2008; Schüz et al., 2011). The necessity-concerns framework (NCF) is a framework used to improve our understanding of the relationship between a patient's beliefs and a patient's medication intake behavior (Clifford et al., 2008). A meta-analysis spanning 17 long-term conditions involving over 10,000 patients showed that the framework had good exploratory value in both cross-sectional and prospective studies (Horne et al., under review).

*Necessity* barriers are associated with a patient's lack of belief in the need for medication. More specifically, beliefs represent the perceived role of medication in protecting against deterioration of the present and future health status of a patient (Horne et al., 1999). It can be thought of the answer to two questions: 'How much do I need this potential benefit?' and 'Can I manage without it?'. These beliefs influence a patient's motivation to begin and continue treatment. Patients with a stronger belief in the necessity of taking their medication as prescribed are less likely to believe that they can cope with their disease without medication (Clifford et al., 2008; Horne et al., 1999).

*Concern barriers* refer to the expected side effects or the fear of becoming too dependent on the medication (Kane & Robinson, 2010). Concerns are a measure of the perceived relevance of the costs and their emotional impact (e.g., how much they worry about potential side effects). It is especially important to consider patients' concerns because patients often report their concerns with medication as the primary reason for poor medication intake behavior (Horne & Weinman, 1999). Concerns are primarily explicit, can be considered a verbalization of an unpleasant emotional state (Zimmermann, Del Piccolo, & Finset, 2007) and are mainly intentional (Kane & Robinson, 2010). An emotional cue (i.e., verbal indication of an underlying unpleasant emotion) can be considered an indicator of concerns. A review of patients' emotional cues concluded that patients generally verbalize one to seven emotional cues during each medical consultation (Zimmermann et al., 2007). Adequate response to a patient's emotional cues is essential because it may reduce a patient's anxiety (Butow, Brown, Cogar, Tattersall, & Dunn, 2002). In addition, it may promote coping with illness (Zachariae et al., 2003), satisfaction with treatment (Uitterhoeve et al., 2008), disclosure of emotions, fewer concerns and worries (Roter & Larson, 2002), and increased recall of information (Jansen et al., 2010). Moreover, responding to a patient's emotional cues offers providers a better understanding of a patient's concerns, which facilitates more adequate responses to these cues and tailoring of information to a patient's emotional needs (Uitterhoeve et al., 2008).

## **The value of tailored communication**

The word *tailoring* is used more frequently by researchers in the field of health communication. *Tailor* stems from the Latin word *talea*, which means 'to cut' (Kreuter & Skinner, 2000). Today, the word 'cut' indicates that a message fits an individual. Tailoring may be defined as "any combination of strategies intended to reach one specific person, based on characteristics that are unique to that person, related to the outcome of interest" (Kreuter, Farrell, Olevitch, & Brennan, 1999, p. 176). The definition should not be used interchangeably with the concept of personalization or targeting. Personalized messages are often generic messages that are used with a person's name to elicit attention, whereas targeted messages are messages for a specific subgroup that are usually based

on a set of demographic characteristics (Kreuter & Skinner, 2000; Maslowska, Putte, & Smit, 2011).

The elaboration likelihood model (ELM) explains the processes underlying the efficacy of tailored persuasive messages. Tailoring provides an opportunity to address the specific preferences and needs of patients; people tend to pay more attention to information that they perceive as personally relevant (Kreuter et al., 1999; Kreuter & Wray, 2003), which may stimulate elaboration via a central route (Petty & Cacioppo, 1986b). A central route leads to deeper processing and more persistent persuasion (Petty, Priester, & Brinol, 2002). When information is tailored to the specific needs of patients, it will be more useful than nontailored information in helping patients implement their desired behavioral changes (Kreuter et al., 1999).

Tailored messages can be useful in the context of health care because poor recall of medical information is often reported as a major problem (Kessels, 2003). Patients are often confronted with a substantial amount of detailed and complex information about their treatment, which is often difficult to understand and recall (Kessels, 2003). Tailored messages will receive more attention; thus, they will be better processed and, consequently, better recalled.

In the past decade, numerous interventions designed to improve successful medication intake behavior have been developed and implemented. These interventions have been delivered through a variety of media. The most typical media used to deliver interventions comprise the Internet (i.e., eHealth), mobile phones (i.e., mHealth), and interpersonal communication. Although tailoring is often associated with the Internet, tailored messages can also be delivered via various alternative media. The manner in which the message can be tailored, however, differs by method.

### **eHealth**

With the introduction of eHealth in the 1990s, opportunities for using communication technology to improve health and the health care system have grown (Oh, Rizo, Enkin, & Jadad, 2005). One of the advantages of eHealth is the ability to efficiently support patients over time. This support is especially relevant to patients living with chronic diseases, which require patients to engage in long-term self-management behavior. Moreover, eHealth has the advantages of being inexpensive, easy to access, and accessible to large populations (Petrie, Perry, Broadbent, & Weinman, 2012).

Computer technology, especially the Internet, can be used to tailor health messages to the personal situation of patients, and may result in a significant contribution to the development of tailored message strategies (Lustria, Cortese, Noar, & Glueckauf, 2009). Computer technology can be used to create tailored health messages that derive from an individual assessment (Kreuter & Skinner, 2000). For example, data from individuals regarding a number of determinants can be collected and can be conceptually or empirically based. Computer-driven algorithms can be used to process patients' data

and generate tailored feedback to meet their needs (Kreuter & Skinner, 2000). By selecting specific determinants related to the behavior, tailoring can be used to enhance cognitive acceptance, preconditions for message processing, and message impact (Hawkins, Kreuter, Resnicow, Fishbein, & Dijkstra, 2008). A review of computerized tailored health interventions concluded that the Internet provides the optimal technology for implementing interventions because it has the capability to assess potential barriers and provides the patient with immediate and tailored feedback (Lustria et al., 2009). Studies of various health behaviors have shown that computer-generated materials that are tailored to the unique needs and interests of patients are more effective than conventional health communication messages (Bull, Kreuter, & Scharff, 1999; Cortese & Lustria, 2012; Prochaska, DiClemente, Velicer, & Rossi, 1993; Smit, de Vries, & Hoving, 2012).

### **mHealth**

In addition to eHealth, another technology that is receiving considerable attention is mHealth. mHealth focuses on the use of mobile communication for health information and services (Nacnovich, 2011). Mobile devices are one of the most significant recent developments in the field of information and communication technology (Chomutare, Fernandez-Luque, Årsand, & Hartvigsen, 2011). According to Nacnovich (2011), mobile devices offer four distinct applications for international development: monitoring of patient medication intake behavior, support, diagnostic treatment, and data collection. With the introduction of mHealth, it also became possible for patients to monitor their health, improve their treatment outside of the hospital, and access health care services anytime and anywhere (Preuveneers & Berbers, 2008). Furthermore, by being 'always on' and 'always worn', mobile phones can provide an intimate and detailed picture of a patient's daily routines and offer affordable, proximate, personalized, and continuous measurement in context (Ramanathan, Swendeman, Comulada, Estrin, & Rotheram-Borus, 2012).

Interventions that employ mobile devices are primarily based on the principles of behavioral learning theory. From this perspective, medication intake behavior depends on stimuli or cues that generate a response that will reinforce successful medication intake behavior (Leventhal & Cameron, 1987). Examples of behavioral interventions include reminders, such as reminders by email, telephone or computer (Peterson, Takiya, & Finley, 2003). Based on a recent review of mobile applications, the enhanced usability and pervasiveness of mobile devices has resulted in a renewed interest in the development of new applications (Chomutare et al., 2011). With the opportunity to use new communication technologies, we can better understand patients and translate this understanding into tailored health messages sent by mobile phones. Computer-mediated algorithms are often used to generate these reminders but can also be used to generate tailored text messages.

## **Interpersonal communication**

The importance of interpersonal communication was acknowledged during the era of Hippocrates. According to the Greek physician and philosopher Hippocrates, “the patient, though conscious that this condition is perilous, may recover his health simply through his contentment with the goodness of the physician” (Blasi, Harkness, Ernst, Georgiou, & Kleijnen, 2001, p. 757). Bensing and Verhaak (2004) justifiably argue that the words of Hippocrates have lost remarkably little of their former appeal. Balint added “not only the medicine...or the pills...but the way the doctor gave them to the patient—in fact the whole atmosphere in which the drug was given” (Blasi et al., 2001, p. 757) and emphasized the importance of interpersonal communication for promoting medication intake behavior. For decades, it was generally thought that patient-provider communication was adequate and that there was no cause for concern. However, evidence suggests otherwise (Stewart, 1995). For example, it was determined that communication is often not tailored to a patient’s needs (Ong, De Haes, Hoos, & Lammes, 1995). It was also determined that poor medication intake behavior is more common among patients whose provider is a poor communicator (Zolnieriek & DiMatteo, 2009). These examples not only stress the importance of effective communication but also highlight the consequences of poor communication.

What is adequate patient-provider communication? When seeking a provider, patients have two basic needs: the need to know and understand (i.e., instrumental communication) and the need to feel acknowledged and understood (i.e., affective communication) (Bensing & Verhaak, 2004). Instrumental communication refers to the provision of information and advice; affective communication refers to the expression of empathy or concern (Bensing & Verhaak, 2004). Previous research on health communication has emphasized the importance of exchanging information (instrumental communication) *and* creating a good relationship (affective communication) (Ong et al., 1995) because many medical problems cannot be solved by only one type of communication. However, many providers do not use both types of communication behavior adequately (Barber, Parsons, Clifford, Darracott, & Horne, 2004; Bernstein et al., 2011; Ong et al., 1995).

First, patients often report unmet informational needs at the time of their diagnosis (Bernstein et al., 2011) or when beginning their medication (Barber et al., 2004). High levels of unmet informational needs are reported in studies of cancer patients (Sanson Fisher et al., 2000; Van Weert et al., 2009), patients with cardiovascular disease (van Geffen et al., 2011), patients with asthma (Koning, Maille, Stevens, & Dekker, 1995), and patients with IBD (Irvine, 2004). An explanation for this finding may be that patients do not clearly express their informational needs. Patients may assume that the provider has informed them of everything or worry that they will appear foolish or consume too much of the provider’s time (Fallowfield & Jenkins, 1999). Patient education should be based on individual preferences, for instance, by directly asking patients about their needs.

However, a previous oncology study determined that providers generally do not adequately explore a patient's personal situation and information needs (Posma, Van Weert, Jansen, & Bensing, 2009). Consequently, providers cannot tailor information to their patients' needs and an information gap may result.

Second, although affective communication is important for predicting patient satisfaction and quality of health care (Bensing, 1991), providers often do not employ affective communication during consultations (Heaven & Maguire, 1996). It has been frequently reported that providers underestimate the affective needs of patients (Heaven & Maguire, 1996; Uitterhoeve et al., 2008). Moreover, providers often find it difficult to address patient concerns (Heaven & Maguire, 1996). As a result, patients may become worried and dissatisfied with their treatment (Suominen, Leino-Kilpi, & Laippala, 1995) and/or with the communication with their providers (Krishnasamy, 1996).

Although evidence suggests that tailoring is important, reviews of patient-provider communication conclude that communication by providers is often not tailored to a patient's needs (Hack, Degner, & Parker, 2005; Ong et al., 1995). Providers fulfilling a patient's needs may lead to symptom resolution, better functional and physiological status and pain control (Stewart, 1995), improved patient satisfaction (Kessels, 2003; Ley, 1979), higher recall levels of medical information (Kessels, 2003; Van der Meulen, Jansen, van Dulmen, Bensing, & Van Weert, 2008), and appropriate medication intake behavior (Barber et al., 2004; Bartlett et al., 1984). Although evidence suggests that tailoring is essential, how we should tailor messages and how message content should be adapted to patients was not determined until recently.

### **Multimedia interventions**

As previously described, various media have advantages regarding the promotion of medication intake behavior. For example, computer technologies can be used to create tailored health messages derived from individual assessments. As a result, this can be used as a tool for providers to optimize the extent to which they tailor interpersonal communication to the needs and barriers of patients. In particular, eHealth and mHealth interventions should not be considered separate interventions, but should rather be considered tools that both patients and providers can use to tailor information to a patient's needs. In marketing and advertising literature, the term synergy is an important concept when considering the effectiveness of persuasive communication. Synergy occurs when the combination of multiple media exceeds the sum of their individual effects (Naik & Raman, 2003; Voorveld, Neijens, & Smit, 2011). However, this concept has rarely been applied to the development of interventions that are designed to improve medication intake behavior. In line with the synergy concept, Sabaté (2003) suggests that these strategies are expected to be most effective when used as components of multimedia programs and implemented in a tailored manner.

## Patients with inflammatory bowel disease

Patients with inflammatory bowel disease (IBD) are identified as the target population for the empirical studies in this dissertation. IBD is a complex chronic inflammatory disorder. The two most common inflammatory bowel diseases are Ulcerative Colitis and Crohn's disease. Data concerning the prevalence of IBD estimate that the worldwide prevalence rate of IBD (i.e., the total number of cases of IBD worldwide) is approximately 396/100,000 persons (Lakatos, 2006). The way that IBD affects a patient's life is highly variable and may depend on the severity of the inflammation in the affected area. Symptoms include abdominal cramps, weight loss, acute urgency to have a bowel movement, pain and fatigue.

IBD patients represent a high-risk group for poor medication intake behavior (Robinson, 2008). Non-adherence rates of 20% to 40% for long-term therapies have been reported (Horne et al., 2009; Sewitch et al., 2003; Shale & Riley, 2003). Several determinants are associated with non-adherence: chronic illness, age (individuals are often diagnosed at a relatively young age), an unpredictable course for the disease, long inactive periods, inconvenient therapies, and side effects (Ediger et al., 2007; Kane, 2007; Van Dulmen et al., 2007; Vermeire et al., 2001). Appropriate medication intake can reduce the probability of relapse for IBD patients (Ediger et al., 2007). Previous research has suggested that patients who do not take their medication as prescribed have a 61% probability of relapse compared with an 11% probability of relapse for patients who adhere to a prescribed medication schedule (Kane et al., 2003).

The treatment of IBD has become complex since the introduction of immunosuppressive and biological therapy (Johnson et al., 2007). For example, biological therapy is prescribed earlier and more frequently as combination therapy than five years ago (Cosnes et al., 2005). Remission of disease is now the primary therapeutic aim, which can be achieved through intensive treatment strategies (Danese, Colombel, Reinisch, & Rutgeerts, 2011). In addition, using immunosuppressive or biological therapy to initially treat IBD is associated with an increased risk of potentially adverse reactions, such as cancer. The likelihood of developing cancer as a result of taking immunosuppressive or biological therapy to treat IBD is very low; however, as soon as these adverse reactions are discussed, this issue may become the focus of attention for patients at the cost of other vital information (Johnson et al., 2007; Wessel, De Kooy, & Merckelbach, 2000). When medication regimens evoke concerns or become more complex, patients are more likely to forget how and when they have to take their medication. Patients are less likely to perform the directives, even though these medications are often administered in the hospital or by other organizations (DiMatteo et al., 2012).

## **Role of nurses in educating IBD patients**

In the Netherlands, nurses play an increasingly important role in educating IBD patients about immunosuppressive and biological therapy and have a key position in understanding and addressing patient barriers to medication intake behavior. When immunosuppressive or biological therapy is prescribed, nurses (primarily nurse practitioners) inform patients about their prescribed medication. Accumulating evidence indicates that the relationship between patient and provider can play a crucial role in influencing satisfaction (Bartlett et al., 1984), recall (Kessels, 2003), and successful medication intake behavior (Hulka, Cassel, Kupper, & Burdette, 1976; Ley, 1979; Ware, Snyder, Wright, & Davies, 1983).

According to guidelines from the National Institute for Clinical Excellence (NICE), nurses should offer all patients the opportunity to be involved in the decision-making process concerning their prescribed medication (Nunes et al., 2009). Based on the Information-Motivation-Strategy model of DiMatteo and colleagues (2012), clinical actions of nurses should address the following points: 1) ensuring that patients have accurate information, 2) assisting patients to overcome perceptual barriers, and 3) assisting patients to overcome practical barriers. For example, nurses are expected to inform patients about the name of the medication and its possible side effects and provide instructions on how to take the prescribed medication. In addition, nurses should be aware that patients will have concerns about their medication and have different perceptions about their personal needs for medication (DiMatteo et al., 2012; Nunes et al., 2009). Nurses are therefore recommended to use a patient-centered approach that enables patients to disclose their concerns (Nunes et al., 2009).

# Aims and outline of this dissertation

## Aims

This dissertation aims to develop a theoretical and evidence-based tailored multimedia intervention to improve medication intake behavior. In addressing this aim, this dissertation gains insight into patient barriers to successful medication intake behavior and investigates the various methods and types of media (i.e., eHealth, mHealth and interpersonal communication) that can promote successful medication intake behavior.

## Outline

The main aim of **Chapter 2** is to investigate which tailored Internet interventions are effective in improving medication intake behavior. Insight into the current developmental stage of these interventions is obtained. Selected studies are assessed for their effectiveness regarding medication intake behavior and to what degree medication intake behavior is determined by the level of tailoring of the intervention. The relationship between the characteristics of the studies and the reported effectiveness of the interventions is also investigated. The main aim of **Chapter 3** is to examine the effectiveness of interventions that use electronic reminders for improving medication intake behavior. To achieve this objective, existing data about the effectiveness of electronic reminders for improving patients' medication intake behavior are synthesized and critically appraised. In addition, the characteristics of electronic reminders that are associated with their effectiveness are investigated. In **Chapter 4**, we investigate how and if tailored communication can be useful for improving medication intake behavior. To achieve this goal, a new communication typology for addressing barriers to successful medication intake behavior is developed, and the relationship between the use of the typology and the barriers to successful medication intake behavior is examined. In **Chapter 5**, the relationship between patient satisfaction regarding communication with nurses and their medication beliefs is investigated. More insight is gained into patients' beliefs about the immunosuppressive or biological therapy that is prescribed for IBD; the results for the same group of patients are compared over a period of 6 months. Next, the relationship between patient satisfaction regarding communication with nurses and their beliefs is examined. **Chapter 6** explores the relationship between recall of medical information and medication intake behavior. Prescribing consultations between nurses and IBD patients are analyzed in a naturalistic environment, and the recall scores of IBD-patients are related to self-reported medication intake behavior. In **Chapter 7**, a multimedia intervention aimed at addressing patients' individual barriers to successful medication intake behavior is described. The development of this intervention is based on

the results of the previously described chapters (see Figure 1) and guided by the Medical Research Council framework.

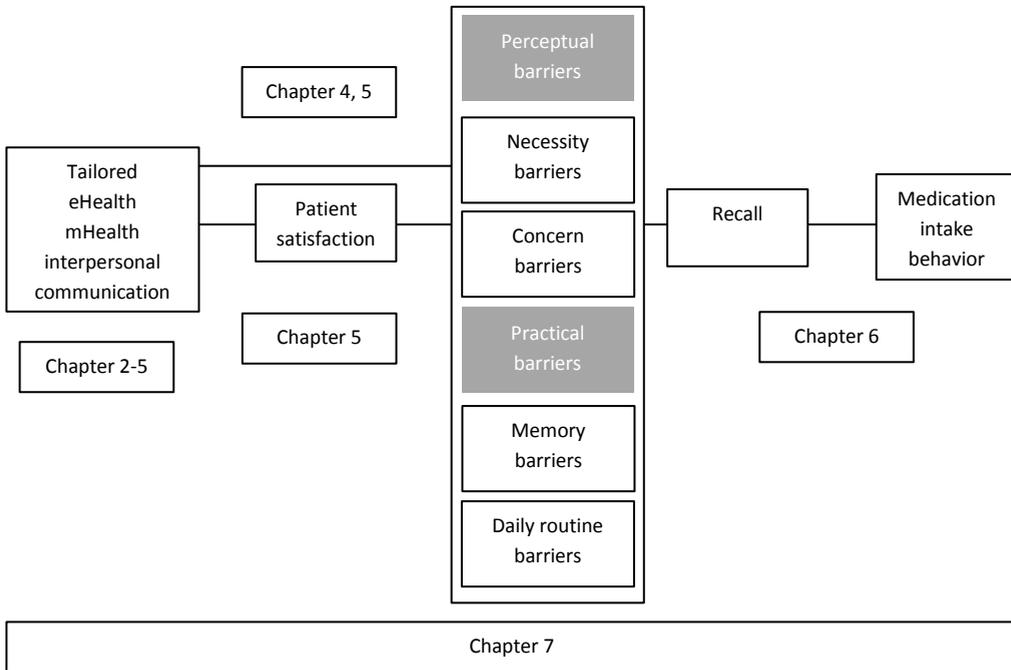


Figure 1. Dissertation outline.

In the final chapter, **Chapter 8**, the findings and the implications of the results of this dissertation are discussed. Moreover, directions for future research and practice are outlined.

The described studies in chapter 4-6 are based on the same dataset and used to structurally develop an intervention (described in chapter 7) to tailor the communication to IBD patients’ barriers and needs. The intervention is currently being evaluated, but this evaluation is behind the scope of this dissertation. Figure 2 shows all the measures used in the described studies, a more detailed description of the measures is given in the chapters concerned. Moreover, Figure 2 displays the time when these measures were assessed.

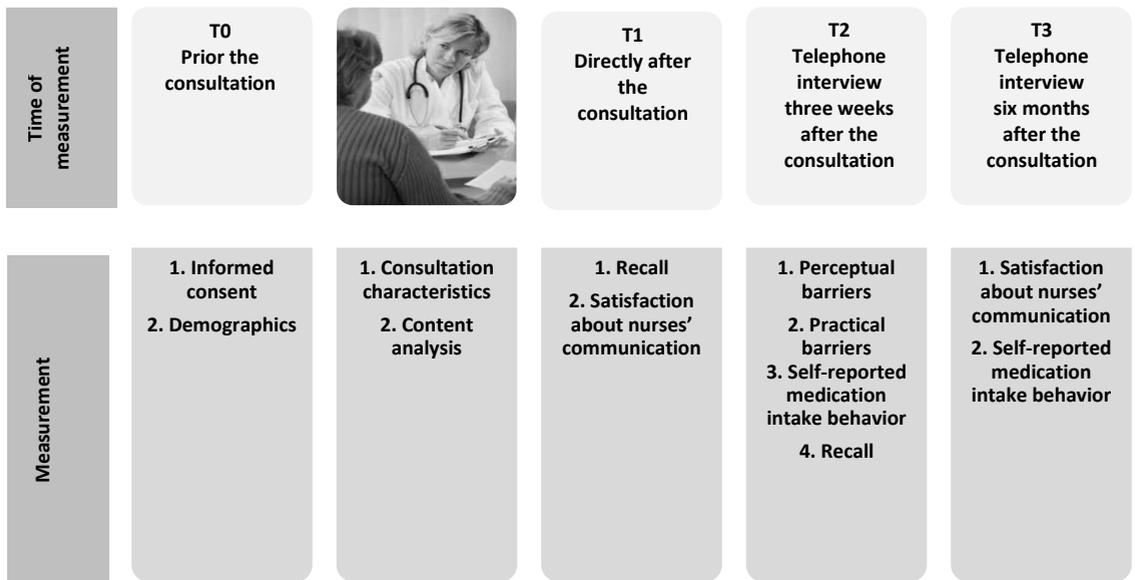


Figure 2. Study overview.